APPROVAL SHEET FOR SUSPENDED LOAD OPERATIONS

SLO-KSC- 1993 - 002

TITLE Assembly and Installation of the VAB 325 Ton Bridge Cranes

DOCUMENT NUMBER/TITLE

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REQUIRED APPROVAL

CONTRACTOR ____ DESIGN ____ R & QA ____ OPERATIONS ____ SAFETY

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NASA SUSPENDED LOAD OPERATION
ANALYSIS/APPROVAL

NUMBER: SLO-KSC-1993-002

OPERATION: To assemble and install the Vehicle Assembly Building (VAB) 325-Ton Bridge Cranes.

SUPPORTING DOCUMENTS - The associated documentation and System Assurance Analysis (SAA) are as follows:

- Contract No. NAS10-11803, VAB 325-Ton Bridge Cranes
- SAA09FY12-005 (Rev A, 08/03/89) 250-Ton Bridge Crane - VAB

GENERAL DESCRIPTION - The task below requires personnel to be directly under the load.

- To connect the two center support posts of the crane cab to the west crane girder, one technician is required to be under the girder while it is suspended from the 250-ton bridge crane. There are three bolts to install at each support post. The crane cab will be at the VAB floor level and the girder will be lifted high enough to connect the cab; approximately 15 feet. The technician will access the crane cab from the VAB floor with a ladder.

RATIONALE/ANALYSIS - The suspended load tasks comply with the NASA Alternate Safety Standard as follows:

Alternate Standard Requirement # 1A: The operation cannot be conducted without personnel beneath the load because the operation has been evaluated and it has been determined that there are no procedural or operational means to eliminate personnel exposure to a suspended load that reduce the hazard level. The option of connecting the cab center posts at the VAB 420-foot level was evaluated and determined to create a greater hazard because of personnel working at heights outside handrails.

Alternate Standard Requirement # 1b: The possible use of a secondary support system to catch the load in the event of a crane failure was analyzed. It was determined that the use of a secondary support system was not feasible because of the size and location of the girder during the suspended load operation.

Alternate Standard Requirement # 1c: The maximum number of personnel permitted under the load at any time is one. It is estimated that the suspended load operation will take 10 minutes.

Alternate Standard Requirement # 1d: Connecting the cab center posts will be accomplished as quickly and safely as possible to minimize exposure time.

Alternate Standard Requirement # 4: This operation is performed by the fixed price contractor. This analysis is the governing document for the suspended load operation.

Alternate Standard Requirement # 6: Suspended load operations involve the VAB 250-ton bridge cranes. The cranes are designed, tested, inspected, maintained, and operated in accordance with NSS/GO-1704.9. The VAB 250-ton cranes are designed with a minimum safety factor of 5 (based on the ultimate material strength) for the hoist load bearing components. The lifting beam assembly meets a design safety factor of 5-to-ultimate strength.

The cranes are equipped with redundant hoist drive systems (including hoist wire ropes and holding brakes) each capable of lifting and holding the load up to the crane's rated capacity. The cranes have a dual braking system with overspeed braking.

The cranes are load tested annually at 100 percent of the rated capacity. Detailed preventive maintenance is performed monthly, quarterly, semiannually, and annually on the cranes to ensure proper operation

The wire rope is inspected monthly for discrepancies. Nondestructive testing of the crane hook is performed annually.

The crane motor generator set is equipped with automatic overspeed protection, which is engaged during lifting operations.

The lifting beam assembly is rated at 150-tons and the girder weighs approximately 140 tons.

Alternate Standard Requirement # 7: A system Assurance Analysis (SAA) has been completed on the crane (SAA09FY12-005 250 Ton Bridge Crane - VAB). The SAA includes a Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and a hazard analysis. Copies of the SAA are on file at NASA Safety - KSC, and NASA Safety - HQ for review.

Alternate Standard Requirement # 8: Visual inspections for cracks or other signs of damage or anomalies are performed on the crane hook and lifting beam assembly before the operation. Crane functional checks are performed before each operation.

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Alternate Standard Requirement # 9: Trained and licensed crane operators shall remain at the crane controls while personnel are under the load.

Alternate Standard Requirement # 10: Appropriate safety zones are established before initiating operations. Only the minimum number of people will be permitted in this area.

Alternate Standard Requirement # 11: A pretask briefing and a safety walkdown of the area are conducted prior to the lift to ensure that all systems and personnel are ready to support.

Alternate Standard Requirement # 12: Personnel beneath the suspended load will be in voice contact with the crane controller and,or signal person.

Alternate Standard Requirement # 13: Ground controllers and E-stop operators are properly positioned during all phases of the lifting operation in full view of the load block, lifting fixtures, and fixture attach points. One E-stop operator, remote from the crane operator's cab, can stop the crane if a failure indication is observed. Personnel working beneath the load shall remain in continuous sight of the operator and,or signal person.

APPROVAL: DATE: 3/25/93

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